SUMMARY OF QUALITATIVE RADIATION SURVEY FINDINGS
FOR WASTE BLACK BEAUTY SANDBLAST ABRASIVE
PARCEL A, IR-59

JULY 12, 1994

1.0 BACKGROUND

EPA requested the Navy to determine if black-colored sandblast grit unearthed at a site within Parcel A, on Naval Facilities Engineering Command, Western Division, Hunters Point Annex (HPA), was a potential source of man-made radioactivity. Sandblast grit was located within one area in the Groundwater Investigation Area (IR-59), bounded on the north by Innes Avenue, on the east by Coleman Avenue, on the south by Jerrold Avenue, and on the west by Friedel Avenue. The blasting material is commonly referred to as "Black Beauty" and is made from crushed and graded coal slag.

Speculation has it that sandblast grit at HPA may contain radioactive mixed fission products. These mixed fission products would have been present on vessels that took part in nuclear weapons testing in the South Pacific. Navy documentation has established that one or more vessels were sent to HPA for decontamination trials after atomic weapons tests demonstrated that decontamination of equipment was not easily accomplished using standard shipboard techniques and were decontaminated by abrasive blasting. The spent abrasive was placed in disposal drums and shipped to a sea disposal area located approximately 25 nautical miles west of the Farallon Islands and approximately 20 miles west of San Francisco. The sea floor at the disposal area is approximately 3600 meters below the surface.

2.0 RADIOISOTOPES AND MATERIALS OF CONCERN

The following sections will describe the radioisotopes and the materials which may be sources of manmade and naturally occurring radioactivity.

2.1 MIXED FISSION PRODUCTS

Mixed fission products are radioactive isotopes that are produced as the result of the nuclear detonation of an atomic weapon. The initial fission product mixture can contain over 200 different radioisotopes, although most of these isotopes have extremely short half-lives and usually become of negligible

importance after 7 or 8 years following a detonation. One half-life is the amount of time required for one-half of a radionuclide to be converted, through radioactive decay, to a more stable atomic state. Two important long-lived mixed fission products are ^{137}Cs, a beta/ gamma emitter, and strontium-90 (^{90}Sr), a beta emitter. ^{137}Cs has a half-life of approximately 30 years, and the half-life of ^{90}Sr is approximately 29 years. As mixed fission products, both of these isotopes can be found together in soil but, because of radiation measurement limitations, it is easier to perform measurements for gamma emissions from ^{137}Cs. Field measurements of gross beta count rates can also be conducted to identify soils exhibiting elevated beta activities.

As the result of hundreds of atmospheric nuclear tests conducted primarily by the United States and the former Soviet Union, ^{137}Cs has become a widespread man-made radioisotope in the environment. The amount of ^{137}Cs soils depends upon the amount originally deposited, the elapsed time since deposition, the soil type, the depth of the soil layer, and the amount of surface erosion or soil tilling that has occurred since deposition. Therefore, the amount of background ^{137}Cs present in surface soils can vary widely from site to site.

If ^{137}Cs soil concentrations are elevated, ^{90}Sr may also be. If ^{137}Cs soil concentrations are elevated and the beta count rate appears greater than would be expected from ^{137}Cs alone, radiochemical analysis for ^{90}Sr will be required to determine its activity. Theoretically, it should be possible to detect ^{137}Cs in soils up to 200 years (approximately eight half-lives) or more after the original deposition. Because ^{137}Cs is present in most surface soils, levels above site background will usually denote contamination from past disposal activities. Because the site may have been covered with a layer of soil that was taken from another location, it is possible that the ^{137}Cs concentration in this cover material may differ from concentrations in soil collected from an adjacent site.

2.2 BLACK BEAUTY SANDBLAST ABRASIVE

The Navy has used Black Beauty® abrasive blasting material for many years. Its low free silica content, abrasive characteristics and low price makes it an attractive alternative to silica sands and more expensive silicon carbide abrasives. Black Beauty is made from coal slag, a waste material produced by coal-fired electric power plants. The virgin material is exempt from RCRA regulation as a listed exclusion to hazardous waste identification in 40 CFR 261.4 (b) (4). Chemically, the material is comprised of 8 distinct compounds.

CHEMICAL ANALYSIS OF BLACK BEAUTY ABRASIVE [a]	
COMPOUND	PERCENT COMPOSITION
Silicon Dioxide	47.20
Aluminum Oxide	21.39
Titanium Dioxide	1.01
Ferric Oxide	19.23
Calcium Oxide	6.80
Magnesium Oxide	1.47
Potassium Oxide	1.60
Sodium Oxide	0.62

[a] From Material Safety Data Sheet, Reed Minerals, Highland, Indiana

Since Black Beauty is made from coal slag, it contains residual naturally occurring radioactive materials (NORM). These naturally occurring radioactive materials can produce enough gamma emissions to be detectable with field instrumentation. Foremost among the NORM isotopes in Black Beauty is radium-226 (^{226}Ra) and its daughters which are derived from the uranium decay series. Some of the primary gamma-emitting radium daughters include: lead-214 (^{214}Pb), bismuth-214 (^{214}Bi) and lead-210 (^{210}Pb). Other NORM isotopes of lesser significance include actinium-228 (^{228}Ac), bismuth-212 (^{212}Bi), and thallium-208 (^{208}Tl) which are derived from the thorium decay series.

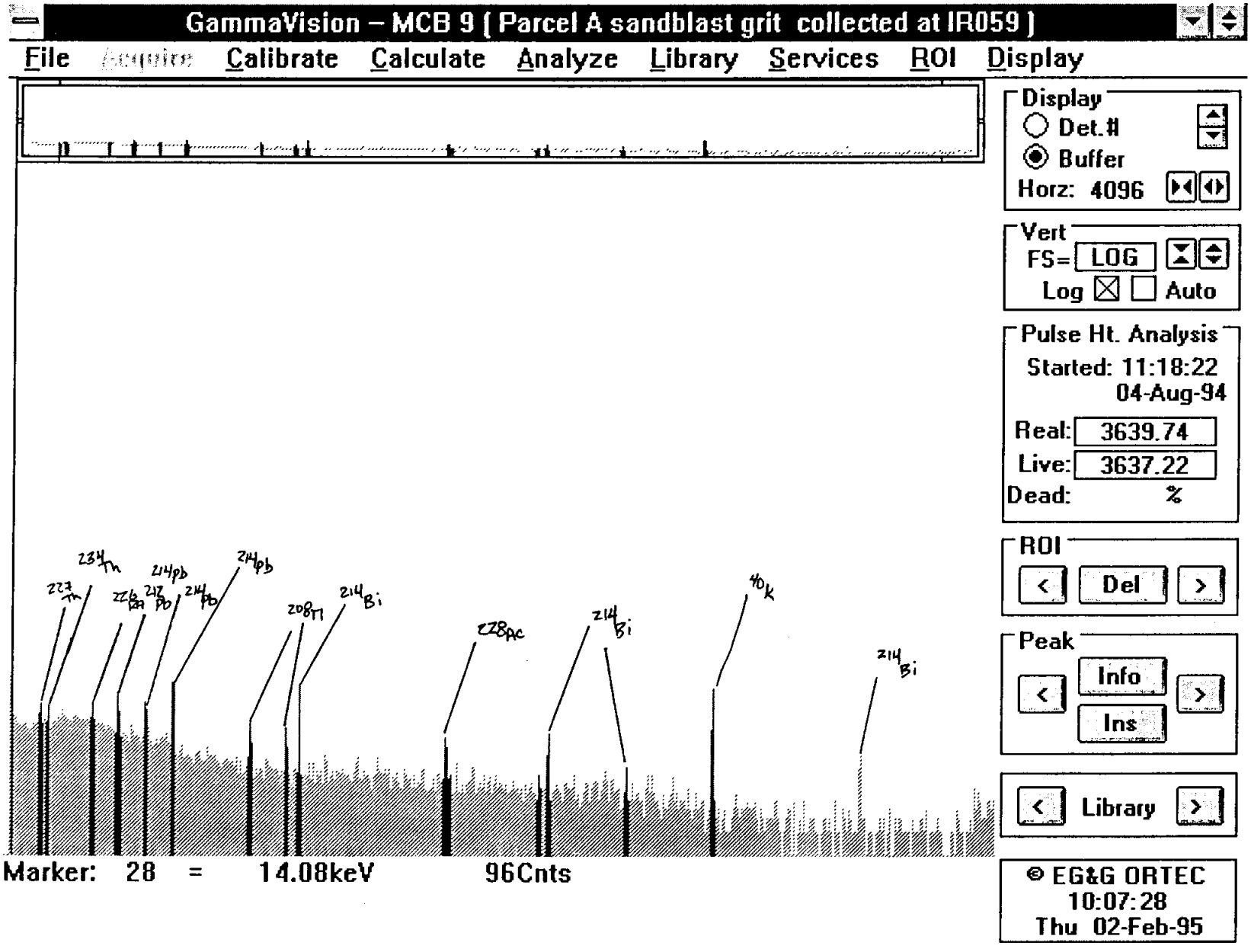
In 1971, samples of typical Black Beauty abrasive were analyzed by the EPA South East Radiological Health Laboratory. Results indicated that the activity of ^{226}Ra and its daughters was 3.7 picoCuries per gram. One picoCurie (pCi) is about 3.7×10^{-2} disintegrations per second.

3.0 FIELD OBSERVATIONS AND SURVEY RESULTS

On July 12, 1994, PRC performed a qualitative investigation for radioactivity within Parcel A at IR-59. Radiation gamma count rate field surveys indicated that the spent Black Beauty type abrasive located there does not exhibit elevated gamma activity. The spent abrasive contained paint chips, soil, and organic debris. The material was found in a location where several 3/4-inch to 1-inch diameter galvanized steel

pipes were buried. The pipes looked as though they had been pulled out of the ground using heavy equipment or had been disposed of and buried.

A sample of the sanblast waste was collected and analyzed using gamma spectroscopy. No mixed fission products were identified in the sample. The activity of naturally occurring radioisotopes were found to be consistent with those found in Black Beauty by EPA South East Radiological Health Laboratory in 1971. A copy of the gamma spectrum, for the IR-59 sample, is provided that identifies the radioisotope that produced the photopeaks shown.


GammaVision – MCB 9 [Parcel A sandblast grit collected at IR059]
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FS= LOG
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Live: 3637.22
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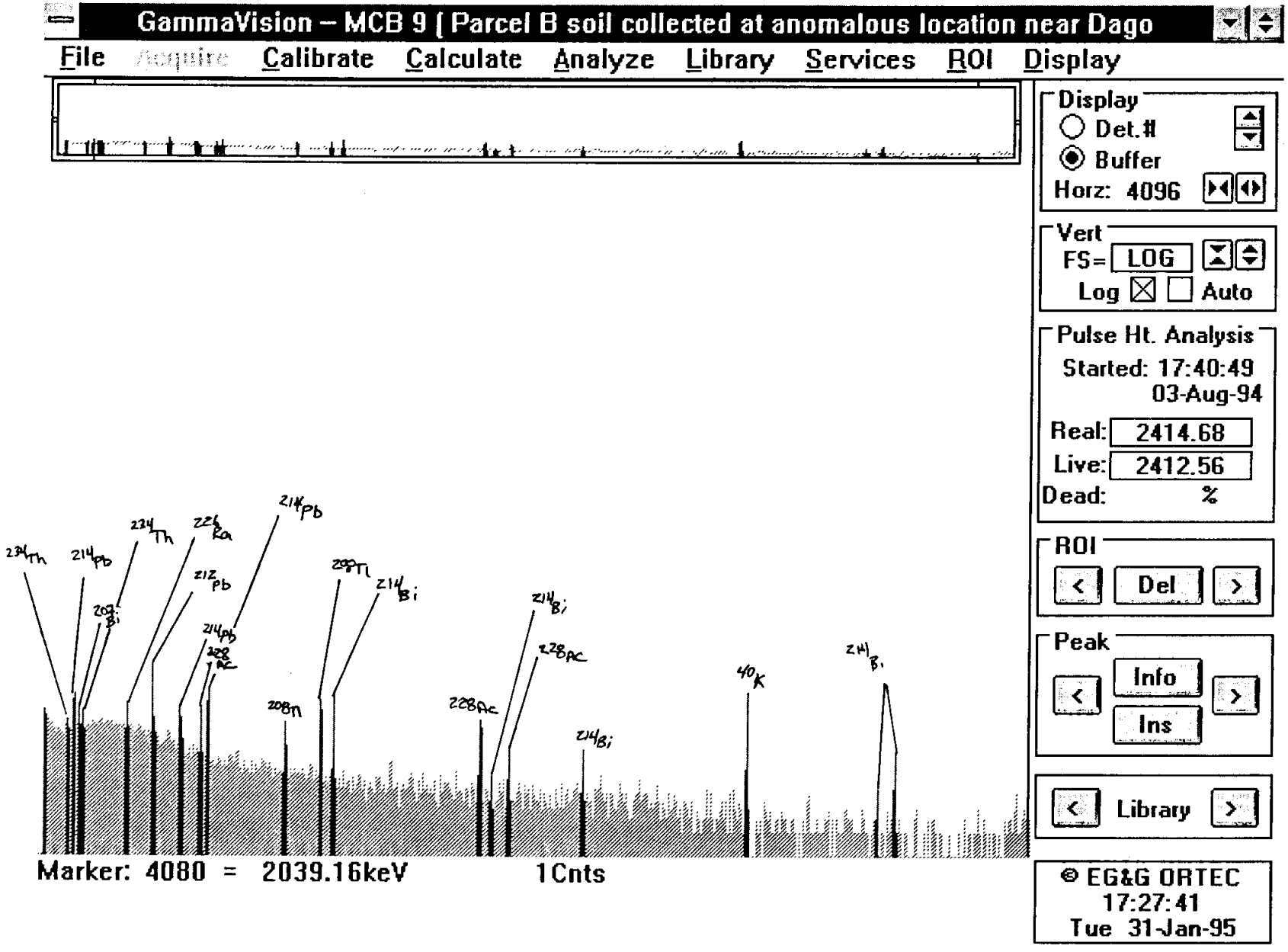
GammaVision – MCB 9 [Parcel B soil collected at anomalous location near Dago
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Horz: 4096
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FS= LOG
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Pulse Ht. Analysis
Started: 17:40:49
03-Aug-94
Real: 2414.68
Live: 2412.56
Dead: %
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